

Claims

What is claimed is:

1. A path module for a linear motor, comprising:  
at least one armature winding;  
an amplifier connected to the at least one armature winding; and  
a module controller coupled to the amplifier, the module controller being operative to control the amplifier to selectively energize the at least one armature winding based on instructions received from a motor controller, the path module being connectable to at least one other path module to define a path, each module in the path having a different address so as to facilitate independent control of armature windings in the path.
2. The path module of claim 1, further comprising a plurality of armature windings, the module controller being operative to control the amplifier to selectively energize each of the plurality of armature windings based on the instructions received from the motor controller.
3. The path module of claim 2, further comprising an amplifier associated with each of the plurality of armature windings in the path module, each amplifier being operative to control energization of an associated armature winding in the path module based on control information from the module controller.
4. The path module of claim 3, wherein each armature winding has a unique address to facilitate independent control of each respective armature winding based on instructions received from a the motor controller addressed to each respective armature winding.
5. The path module of claim 1, further comprising a plurality of the path modules connected together, the at least one armature winding in each of the plurality of

path modules being arranged so as to define the path, the armature windings in the path being independently addressable through each associated module controller, such that independent control of the armature windings is facilitated.

6. The path module of claim 1, further comprising an encoder sensor operative to provide an output signal to a communications link indicative of at least one of incremental and absolute changes in position of a stage relative to the path module.

7. The path module of claim 6, wherein the encoder sensor further comprises a magnetic encoder sensor responsive to an encoder magnet of a stage, the encoder magnet having an effective length.

8. The path module of claim 7, wherein the path module is connectable to an adjacent path module having at least one encoder sensor, such that when the path module is connected to the adjacent path module, the at least one encoder sensor of the path module and the at least one sensor of the adjacent path module are separated by no more than the effective length.

9. The path module of claim 1, further comprising at least one sensor operative to sense a condition of the path module and provide a signal indicative of the sensed condition to the module controller.

10. A path module for a linear motor, comprising:  
a plurality of non-interlaced armature windings;  
an amplifier connected to the plurality of armature windings; and  
a module controller coupled to the amplifier, the module controller being programmed to control the amplifier to selectively energize the plurality of armature windings based on instructions received from a remote motor controller, the path module being connectable to at least one other path module to define a path.

11. The path module of claim 10, further comprising an amplifier associated with each of the plurality of armature windings in the path module, each amplifier being operative to control energization of an associated one of the plurality of armature windings based on control information from the module controller.

12. The path module of claim 11, wherein each armature winding has a unique address to facilitate independent control of each respective armature winding based on instructions from the motor controller addressed to each respective armature winding.

13. A linear motor system, comprising:  
a plurality of path modules, each of the plurality of path modules comprising:  
at least one armature winding;  
an amplifier connected to the at least one armature winding; and  
a module controller associated with the amplifier and operative to control the amplifier to selectively energize the at least one armature winding based on control instructions via a communications link;  
each of the plurality of path modules being connected to at least one adjacent path module to define a path;  
a stage moveable along the path; and  
wherein the module controller of each of the plurality of path modules is operative to receive respective control instructions via the communications link, the module controller of each of the plurality of path modules further being operative to control an associated amplifier to selectively energize the at least one armature winding associated therewith based on the control instructions received by the associated module controller so as to effect movement of the stage along the path.

14. The system of claim 13, wherein the at least one armature winding further comprises a plurality of armature windings, the module controller of each of the plurality of path modules being operative to control each respective amplifier to selectively

energize each of the plurality of armature windings based on the control instructions received by the associated module controller.

15. The system of claim 14, wherein the module controller of each of the plurality of path modules further comprises an amplifier associated with each of the plurality of armature windings in the associated path module, each amplifier being operative to control energization of an associated armature winding.

16. The system of claim 13, further comprising a system controller operative to provide the control instructions to each of the plurality of path modules via the communications link so as to control the at least one armature winding associated with each of the plurality of path modules.

17. The system of claim 16, wherein the communications link employs an addressable communications protocol in which each of the plurality of path modules in the path has a different address, the system controller providing the control instructions according to the address of each of the plurality of path modules.

18. The system of claim 16, wherein each armature winding in the path has a different address, the system controller utilizing the address of each of the armature windings in the path to effect substantially independent control of the armature windings.

19. The system of claim 18, wherein the at least one armature winding further comprises a plurality of armature windings, the module controller of each of the plurality of path modules being operative to control each respective amplifier to selectively energize each of the plurality of armature windings based on the address associated with control instructions received by the respective module controller.

20. The system of claim 19, wherein the module controller of each of the plurality of path modules further comprises an amplifier associated with each of the

plurality of armature windings in respective path module, each amplifier being operative to control energization of an associated armature winding.

21. The system of claim 16, wherein the system controller is operative to receive encoder data indicative at least one of incremental and absolute changes in position of the stage relative the path, the system controller providing the control instructions based on the encoder data.

22. The system of claim 21, further comprising at least one receiver coupled to the system controller, the at least one receiver being operative to receive a wireless signal having at least some of the encoder data.

23. The system of claim 13, wherein at least some of the plurality of path modules further comprise at least one sensor operative to sense a condition of the respective path module and provide sensor data indicative of the sensed condition via the communications link.

24. The system of claim 23, further comprising a computer coupled to the communications link and operative to collect the sensor data.

25. The system of claim 24, wherein the computer further comprises computer executable instructions to analyze operating characteristics of the linear motor system based on the sensor data and provide an indication of the operating characteristics.

26. A path module for a linear motor, comprising:  
field means for providing an electric field;  
amplifier means for controlling the electric field provided by the field means; and  
control means for selectively controlling the amplifier means based on instructions identifying the field means, the path module being connectable to at least one

other path module to define a path, whereby each module in the path has a different address so as to facilitate independent control of different field means in the path.

27. A linear motor system, comprising:

a plurality of path modules, each path module comprising:

field means for providing an electric field;

amplifier means for controlling the electric field provided by the

field means; and

control means for selectively controlling the amplifier means based on instructions identifying the field means;

each of the plurality of path modules being connected to at least one adjacent path module to define a path;

support means moveable along the path; and

communication means for communicating control information to each of the control means in the linear motor system, each control means being operative to control the respective amplifier means to selectively energize the field means associated therewith based on the control instructions received by the respective control means so as to control movement of the support means along the path.

28. A method for controlling a path module in a linear motor system, comprising:

receiving at a controller of the path module via a communications link control instructions from a motor controller; and

providing control data to an amplifier of the path module to selectively energize at least one armature winding of the path module based on the control instructions, the control instructions identifying the at least one armature winding.

29. The method of claim 28, further comprising receiving encoder data at the motor controller indicative of at least one of movement and position of a stage relative to a path provided by the linear motor system, the control instructions being provided based on the encoder data.

30. The method of claim 29, wherein the encoder data is received at the motor controller via the communications link.

31. The method of claim 29, wherein the encoder data is received at the motor controller via a wireless receiver operatively associated with the motor controller.

32. The method of claim 28, wherein the path module includes a plurality of armature windings and an amplifier associated with each of the plurality of armature windings in the path module, the method further comprising controlling each amplifier to control energization of an associated one of the plurality of armature windings based on the control instructions received at the path module from the motor controller.

33. The method of claim 32, further comprising addressing the control instructions for receipt by the controller of the path module so as to effect energization of at least one of the selected armature windings in the path module.